

## ABSTRACT

Methods, compositions and devices are provided based on changing the binding strength of an adhesion molecule to a ligand by changing the force exerted on the bound complex between adhesion molecule and ligand, for example by changing the shear stress acting on the complex. The adhesion molecules and their ligands of this invention bind more tightly when a force-activated bond stress, such as shear force, applied to the adhesion molecules is increased, and bond less tightly when the stress is decreased. The adhesion molecules can be isolated from their sources in nature or can remain attached to their natural sources. They can be engineered, *e.g.*, by altering their amino acid sequences or by binding to antibodies or other particles, to alter their binding properties. They can be attached to a wide range of substrates including particles and device surfaces to form adhesive systems which are capable of sticking to other particles and/or device surfaces to which ligands for the adhesion molecules have been attached. The adhesion molecules and ligands described herein can be used to control binding and release of components of an adhesive system by increasing or decreasing the force-activated bond stresses applied to the adhesion molecules.